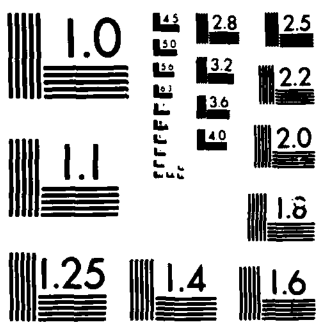
AD-A163 887 OVERVIEW OF SPACE TECHNOLOGY(U) FOREIGN TECHNOLOGY DIV 1/1
WRIGHT-PATTERSON AFB OH Z YANG 15 JAN 86
FTD-ID(RS)T-1029-85

UNCLASSIFIED F/G 22/1 NL

END
FILMED
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

FTD-ID(RS)T-1029-85

AD-A163 887

FOREIGN TECHNOLOGY DIVISION

AIR FORCE SYSTEMS COMMAND

OVERVIEW OF SPACE TECHNOLOGY

by

Yang Zhongcheng

DTIC
ELECTE
FEB 7 1986
S D
B

FOREIGN TECHNOLOGY DIVISION

DTIC FILE COPY

Approved for public release;
distribution unlimited.

86 2 7 004

EDITED TRANSLATION

FTD-ID(RS)T-1029-85 15 Jan 86

MICROFICHE NR: FTD-86-C-001359

OVERVIEW OF SPACE TECHNOLOGY

By: Yang Zhongcheng

English pages: 9

Source: Hangkong Zhishi, Vol. 6, Nr. 11, November 1984, pp. 14-16

Country of origin: China
Translated by: SCITRAN
F33657-84-D-0165
Requester: FTD/TQTA
Approved for public release; distribution unlimited.

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

OVERVIEW OF SPACE TECHNOLOGY

Yang Zhongcheng

Space technology became noticeable in the late fifties. On October 4, 1957, the Soviets launched the first man-made Earth satellite. This event signified a new era for human exploration in space history. Time flies like an arrow. Since then, a quarter of a century has passed. Today, this new technology has been extensively applied and has become a major milestone for modern scientific techniques. It is also one of the important contents of the current technological revolution which has been closely watched by people. /14

Current status of space activity

Over 26 years, space technology has acquired rapid developments. It is becoming a matured science. There are seven countries in the world that have used self-manufactured launch vehicles to send satellites into orbit. Besides China, they are Russia, the United States, France, Japan, the United Kingdom and India. Human beings first landed on the moon 15 years ago. Since then, there have been more than 140 astronauts who participated in manned space activities. All kinds of space probe vehicles have approached five major planets in the solar system for exploration. A lot of secrets in our universe were revealed. All of these application satellites or manned vehicles played a very important role in both promoting the civil economy development and military applications.

Currently, if we try to divide all the countries involved in space activities according to their investment amount into this venture, their scale of operations, and if they had the independent ability to initiate a launch on their own, we can categorize all these countries into three types.

The first category consists of the United States and the Soviet Union. Their space activities serve their individual global strategic interests. Competitions between the two countries are very intense.

Because the two super powers both possess strong economic support, they have invested enormously both in human effort and in materials. Plus the fact that they initiated the endeavors way ahead of others, hence the scales of space operations of these two super powers are impossible for others to match.

The United States has invested over twenty-some years a total of 150 billion dollars in space activity. Current annual spending is over 10 billion dollars. It accounts for approximately 0.5% of her gross national product value. Several hundred thousands of people are directly involved in space related businesses. It has been analyzed and concluded that during the same time frame, the Soviet Union has put even more human and financial resources into space activities. The Soviet Union now conducts about 100 launches a year while the United States has only about 20.

The second category consists of Japan, organizing members of the European Space Agency and India. These countries have been more and more active to pursue space activities. Major characteristics lie in that they only base their programs on specific national requirements, with less human and financial resources investments, to selectively pursue space projects. They do not compete, on the full scale, with the super powers. However, they want to get rid of the dependence on the super powers and retain the independent nature of their space programs.

Over the years, Japan spent around 100 billion Japanese yen every year on space projects, which is equivalent to 500 million U. S. dollars. It has accounted for around 0.05% of her gross national product value. France spends two billion francs, which is equivalent to 300 million U. S. dollars. This accounted for 0.1%

of her gross national product. In these countries, the inefficiency in both funding and technical know-how has prompted international cooperation. In Western Europe, an international corporation was even realized. The European Space Agency was formed in 1975. The space programs conducted by these countries are generally closely related to the civil economy. Major spendings and technical efforts are directed towards applications such as meteorology, communication, television broadcast, terrestrial observation and the design/development of launch vehicles.

The third category consists of countries like Indonesia, Australia and the Arabic countries. These nations usually do not deal with satellites and launch vehicles. They mostly share existing space technology with foreign countries. Based on national requirements, they purchase satellites and related ground systems. Sometimes they also participate in international cooperations.

From the technical point of view, the development of space technology over the twenty-some years can be divided into three phases. The first phase is from the launch of the first satellite in 1957 until the middle sixties. This was mostly a period for trial and experiment. The second phase is from the middle sixties to the early eighties. It has been a period of expanding activities. Within this phase, both the United States and the Soviet Union have launched all kinds of military satellites for reconnaissance, communication, early warning, meteorology, navigation and remote sensing. The accomplishments of space technology from military applications began to transfer to civil sectors in great quantity. The third phase began in April 1981 when the United States space shuttle successfully conducted its test flight. This is a period in which lower space flight costs and higher launch efficiency are to be achieved. These are the characteristics of the third phase.

The development of space technology

Space technology is a branch of science that is highly sophisticated and integrated. Although it has very close relations with many academic principles, however, basically it is composed of launch technology and vehicle technology. The development in the past twenty-some years can be described from these two angles.

The launch rocket is the key issue for a country wishing to pursue independent space activity. From the history of the United States and the Soviet Union, the development of the space launch rockets can be divided into two steps. The first step is to convert existing ballistic missiles. The payload was enhanced through horizontal strap-on boosters on the bottom, vertical improved upper stages or expanded propellant tanks. The series of launch rockets was thus formed. This satisfied the requirement of advancing space programs. The conversion of the "Delta" series launch rockets (Figure 1) in the United States is a typical example. This series was based on the Thor medium-range ballistic missile system /15
and further developed. It had a total of more than 10 variations. The second step is to specifically develop large scale launch rockets to fulfill the requirements of special space launch missions. For example, the United States developed the series of Saturn launch rockets for the manned moon exploration projects "Apollo" (see Figure 2). In order to launch the "Proton" satellites as well as the "Salyut" space station, the Soviets developed the "Proton" large launch rockets.

Although the rockets are developed in series which can facilitate the saving of costs on space activities as well as enhancing the reliability and efficiency, they can be used only once. This results in extremely huge expenses for space activities. In order to lower the costs of space projects and improve the efficiencies, current space technologies are being developed in three directions: (1) continue to improve current launch rockets in series (including the possibility of recovering certain parts for re-use); (2) study

the design of cheaper rockets for one-time use. So-called cheap rockets use lower cost materials and components that are simple in configuration, at the same time trying to standardize the components to lower the cost and improve reliability; (3) study space shuttles. A space shuttle is a space vehicle that can be used repeatedly. Unlike the rockets which have to be dumped after use, the space shuttle can significantly reduce the cost of launching. It is claimed that the cost of launching one kilogram of effective payload into a geosynchronous Earth orbit by the space shuttle is only one-half of the cost of using current launch rockets. If the payload is to be launched to a near-Earth orbit, the cost of using a space shuttle is only one-sixth of that of using rockets.

With the scale of space projects expanding constantly, the economic related problems of space activities become more and more prominent. In all the technical approaches to lower the costs of space prograns, all countries are now in favor of the space shuttle. However, the space shuttle is a highly complicated system; it requires enormous research and development funding and state-of-the-art technological standards. Therefore, for nations whose technology as well as economy are still in a developing stage while space activities are on a relatively small scale, the space shuttle is not so urgent a matter to pursue. It will be rather more practical to work on improvements of current launch rockets.

Space vehicles are used to directly accomplish space projects. Based on a preliminary statistical result, by the end of 1983 a total of more than 3000 space vehicles of all kinds were launched by all the nations in the world. Among them, the Soviets have 1880 while the United States has 966. Vehicles to perform military services accounted for 76.9% and 66.9% of the total number of those launched by the Soviets and the United States respectively.

Currently, the size and weight of all the space vehicles are strictly limited by the capacity of launch rockets. Generally

speaking, they could only be launched separately according to different requirements. It was because of this that vehicles performing single functions accounted for most of the units. Their lifetimes are usually shorter. This, in turn, makes the current space vehicles complicated in variations, large in quantities and expensive in costs. With the development of technologies in the areas of space launching, electronics and remote sensing, new directions have been observed in the design and application of space vehicles as follows:

1. Integration of applications. This will benefit more parties with one single launch.

Actual foreign space activities have proven that in the near-Earth orbit if only the terrain resolution of the camera on a meteorological satellite could be enhanced, it could also be used to explore resources on Earth. It is also possible that an Earth resource exploration satellite be used for military surveillance. In the geosynchronous orbit, if the electric power permitted, the same satellite could be used not only for communication, but also for television broadcast and meteorological observation. There has been a satellite with multiple functions of communication, television broadcast and meteorological observation in recent years.

The multiple-function satellite has created the possibility of benefiting more parties with one launch. This type of satellite will employ only one system for the power supply, status control and remote control. It can perform more missions. When compared with multiple launches of single-function satellites, this will not only enhance the loading factor and lower the costs, but also makes it possible for centralized management/control. For geosynchronous orbit, the multiple purpose satellites will alleviate the problem of "over crowdedness".

2. <u>Standardized design and modulized components</u>

From the middle sixties until now, the Soviets have standardized their designs both for the satellite body and satellite equipment (for example, power supply, remote control and communication systems). The interior of the satellite is divided into two compartments. One is the basic compartment, the other is the working load compartment. Only the working load compartment has to be changed; the satellite can then fulfill different functional requirements. The United States D-version satellite is also a typical example of standardized compartment design. Its standard public compartment consists of multiple basic functions, such as electric power supply, propulsion, status control, communication and data processing. Its specific equipment compartment can be used to provide effective a payload for other scientific research or applications based on different requirements of the missions. The entire satellite can be launched and recovered by space shuttles.

The standardized and modulized design of the space vehicles have facilitated the integration and functional tests. It also made it possible to use the space shuttle to perform maintenance and repair work in orbit.

3. <u>More utilization of the synchronous orbits</u>

The space vehicles that circulate the Earth can operate in two synchronous orbits. One is the geosynchronous orbit while the other is the solar synchronous orbit. These two orbits have their respective advantages. Currently, communications, early-warning and meteorological satellites are mostly put into the geosynchronous orbit. The terrestrial observation satellites such as the ones for surveillance, Earth resources exploration and meteorological observations are mostly put into the solar synchronous orbit.

4. <u>The development of near-Earth space becomes an emphasis</u>

In the foreseeable future, the center of activity of human beings will remain on Earth. People will use the accomplishments of space technology to solve problems on Earth. However, this will be only to a certain degree.

The near-Earth space underneath the geosynchronous orbit will definitely become the emphasis of further development and utilization.

5. <u>The appearance of anti-satellite weapons may cause space to become a new theater of war</u>

Outer space is the new arena for the arms race between the two super powers. From the early sixties until now, both the Soviet Union and the United States have put a lot of emphasis on all technical approaches to study anti-satellite technology. Until now, both have acquired significant advancements. The Soviets now have anti-satellites capable of attacking satellites in low orbit. The United States has proceeded with a faster pace since 1977 to pursue anti-satellite weaponry development. Earlier this /16
year, they conducted test flights on small anti-satellite missiles. At the same time, both countries have extensively studied laser and particle-beam anti-satellite weaponry.

The appearance of anti-satellite weaponry is an important direction in the development process of space technology. It has now made the man-made satellites not only a means of reconnaissance, communication and navigation but also an attack weapon.

Because the military applications of command, control, communication and intelligence have relied more and more on space systems and the constant development of anti-satellite weaponry, the possibility of military space systems being attacked is constantly increasing. Therefore, outer space very likely will become a new theater of war in future confrontations.

However, it must be pointed out that any possible confrontations in outer space all have the common goal of winning battles on the ground. The major factors influencing the outcome of ground battle will still be the nature of war and the morale of the people. The new advanced weaponry will not be such factors. (to be continued)

图一 美国"德尔它"运载火箭

Figure 1. The U. S. "Delta" launch rocket

图二 美国的"土星-5"运载火箭

Figure 2. The U. S. "Saturn-5" launch rocket

END

FILMED

3-86

DTIC